REMARKS

Claims 1-13 are pending in this application, with claims 1-4 and 10-12 withdrawn from consideration. Claims 5, 8 and 9 are canceled without prejudice or disclaimer, claims 6 and 13 are amended, and claims 14-17 are newly added herein. Upon entry of this amendment, claims 1-4, 6, 7 and 10-17 will be pending, with claims 1-4 and 10-12 withdrawn. The specification is also amended herein to correct typographical errors. Entry of this amendment and reconsideration of the rejections are respectfully requested.

No new matter has been introduced by this Amendment. Support for the amendments to the claims is as follows:

Support for amended claim 6 can be found in original claim 8, and at page 19, lines 26-29, and page 16, lines 9-18 of the present specification.

Claim 13 has been amended to depend from claim 6.

Support for new claim 14 can be found on page 16, lines 16-18, of the present specification.

Support for new claim 15 can be found on page 20, line 32, of the present specification.

Support for new claim 16 can be found on page 9, lines 31-32, of the present specification.

Support for new claim 17 can be found on page 9, line 35, and Examples 1 to 6 of the present specification.

Claims 6-7 are rejected under 35 U.S.C. §103(a) as being unpatentable over Barney in 2002/0110180. (Office action paragraph no. 5).

The rejection is overcome by the amendment to claim 6, which has been amended as follows:

> A fluorescent material ~~wherein~~ comprising semiconductor ultrafine particles [[with]] having 20% or more fluorescence quantum yield of photoluminescence [[are]] dispersed in a glass matrix formed by a sol-gel process using an organoalkoxysilane represented by General Formula:
> $X\text{-}Si(OR)_3$
> wherein X is a group containing a vinyl group, a group containing an epoxy group, an amino alkyl group, an acryloyl alkyl group, a methacryloyl alkyl group, a mercapto alkyl group or a phenyl group, OR is an alkoxy group.

The amendment clarifies the composition by explicitly reciting that the fluorescent material comprises the recited semiconductor ultrafine particles. In addition, the claim has been amended to recite "formed by a sol-gel process using an organoalkoxysilane represented by General Formula $X\text{-}Si(OR)_3$ ..." This incorporates the recitation of original claim 8 of using an organoalkoxysilane, and the disclosure of the General Formula at page 16, lines 9-18.

Applicant submits that Barney does not disclose or suggest that semiconductor ultrafine particles (nanoparticles, nanocrystals) formed in a solution are dispersed in a glass matrix using an organoalkoxysilane represented by General Formula (1). Moreover, Barney does not disclose ultrafine particles having 20% or more fluorescence quantum yield **in the fluorescent material**.

Regarding the fluorescence quantum yield, in the fluorescent material of Barney, semiconductor ultrafine particles formed in a solution are dispersed in a solid matrix. Paragraph [0018] discloses that the fluorescent material of Barney **can have** emission quantum efficiencies (i.e., fluorescence quantum yield)

greater than 10%, 20%, 30%, 40%, 50%, 60%, 70%, or 80%; however, these values are considered the fluorescence quantum yields of ultrafine particles themselves, rather than those of ultrafine particles **in the fluorescent material**. Further, in the Examples of Barney, neither the fluorescence quantum yields of ultrafine particles in the solution nor those of ultrafine particles in the fluorescent material were examined. Based on the above, the limitation of claim 6 regarding the values of the fluorescence quantum yields is not actually explicitly disclosed in Barney.

Further, as noted above, claim 6 recites that ultrafine particles are dispersed in a matrix formed by a sol-gel process using an organoalkoxysilane represented by General Formula (1) above. By utilizing an organoalkoxysilane having an organic functional group on a silicon atom and modifying the production method as needed, the ultrafine particles can be dispersed in the glass matrix at a concentration sufficient for the fluorescent material without reducing the fluorescence quantum yields. Barney does not disclose this step, and Barney does not suggest the use of organoalkoxysilane.

Paragraph [0039] of Barney discloses a material in which ultrafine particles are dispersed in a poly(lauryl methacrylate) polymer ($(-CH_2-C(CH_3)(COO(CH_2)_{11}CH_3)-)_n$). However, the material of the matrix is an organic polymer, rather than a glass matrix formed from an organoalkoxysilane. As described in the present specification on page 5, lines 1 to 13, the use of the polymer matrix (Advanced Materials, vol.12, 1102 (2000)) results in degradation of the ultrafine particles due to the permission of water and oxygen, or likely generates aggregation if the dispersion concentration of the ultrafine particles is high. Accordingly, the effects of the present invention cannot be achieved.

Paragraph [0041] of Barney discloses a method for dispersing ultrafine particles in a titanium oxide matrix by a sol-gel process using tetrabutoxy titanate. However, since tetrabutoxy titanate has a high hydrolysis rate, and the affinity of titanium oxide with the surface of the ultrafine particles is poor, ultrafine particles cannot be obtained at a high dispersion concentration. Furthermore, when the titanium oxide matrix is exposed to excitation light, photocatalytic reaction occurs, thereby ultrafine particles dispersed therein are rapidly discolored. That is, this method cannot achieve a stable glass matrix with a high dispersion concentration. In fact, the example of paragraph [0041] does not disclose the dispersion concentration.

Paragraph [0042] of Barney discloses a material in which ultrafine particles are dispersed in a silicone polymer matrix at a concentration of 0.1 mM. Silicone polymer is represented by General Formula: $(\text{-SiRiR}_2\text{-O-})_n$, wherein R_1 and R_2 are each an alkyl group, aryl group, or the like. This polymer is not formed by a sol-gel process including a hydrolysis process. Further, the resulting matrix is a one dimensional polymer that comprises -Si-O-Si- as a main chain, and does not have a three dimensional network structure as in the present invention. Therefore, such a polymer is not a glass.

Additionally, paragraph [0030] of Barney discloses an inorganic matrix (e.g., sol-gel-derived matrix), and paragraph [0032] discloses a hydrolyzable composition (e.g., silicon alkoxide). However, such descriptions merely indicate a typical inorganic tetraalkoxide represented by $(RO)_4Si$, and thus Barney does not teach or suggest the organoalkoxysilane of General Formula (1) as defined in the present invention.

Moreover, Barney does not recognize the difficulty of dispersing ultrafine particles in a matrix while maintaining their fluorescence quantum yields. In the fluorescent material of the present invention, ultrafine particles having a high brightness and fluorescence quantum yield are dispersed in a glass matrix at a high concentration. Such a fluorescent material is excellent in properties such as mechanical, heat-resistance, chemical stability, etc., as well as light resistance and stability with the passage of time, and therefore can be effectively used in various applications, e.g., a lighting device, a display element, etc.

Referring to the descriptions above, the Examiner states that dispersing ultrafine particles in the sol-gel-derived glass of silicon alkoxide at a specific concentration (0.1 mM) is obvious. However, as explained above, since Barney does not suggest the organoalkoxysilane of General Formula (1), the Examiner's assertion can be disregarded. Furthermore, a person skilled in the art cannot predict the effects (such as excellent fluorescence quantum yield, mechanical properties, heat-resistance properties, chemical stability properties, etc.) of a matrix using the organoalkoxysilane of the present invention.

Claims 6 and 7 are therefore not obvious over Barney (2002/0110180).

Claims 5, 8-9 and 13 are rejected under 35 U.S.C. §103(a) as being unpatentable over Barney in 2002/0110180 in view of Chan in his publication entitled "Luminescent quantum dots for multiplexed biological detection and imaging". (Office action paragraph no. 6).

The rejection of claims 5 and 8-9 is moot in view of the cancellation of these claims without prejudice or disclaimer.

The rejection of claim 13 is overcome by the amendment to claim 6, and the amendment of claim 13 to depend from claim 6. As discussed above, claim 6 is not obvious over the Barney reference. Chan is cited as teaching that quantum dots can be passivated an made nearly immune to the destructive effects of water, and that such particles can have a quantum yield of 50% after a period of 2 years in a buffer solution. However, as discussed above, Barney does not disclose or suggest that semiconductor ultrafine particles (nanoparticles, nanocrystals) formed in a solution are dispersed in a glass matrix using an organoalkoxysilane represented by General Formula (1), and the disclosure of Chan does not correct this deficiency.

Base claim 6 and its dependent claims, including claim 13, are therefore not obvious over Chan and Barney, taken separately or in combination.

Regarding new claims 14-17.

New claims 14-17 all depend from claim 6. As discussed above, claim 6 is not obvious over the cited Barney and Chan references, so new claims 14-17 are also not obvious over these references.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact the applicants' undersigned agent at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, the applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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Enclosure: Petition for Extension of Time

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